Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the

application:

Listing of Claims:

1.   (Currently Amended) A method of defining a storage format in multiple

data storage devices, each data storage device having a plurality of storage media and a

plurality of corresponding data transducer heads, each ~~transducer~~ head for recording on

and playback of information from a corresponding storage media ~~medium~~ in multiple

5   zones, the method comprising the steps of:

(a)   (1) for a sample number of said data storage devices, measuring a

performance of each head in the sample number of said data storage devices at one or

more read/write frequencies per zone, and

(2) for said multiple data storage devices, based on said performance

10   measurements, jointly ~~jointly:~~ selecting a group of read/write frequencies, two or more

read/write frequencies for each zone, and allocating one or more of the heads in each of

the multiple data storage devices to each frequency in said group of frequencies per zone;

and

(b)   in each of said multiple data storage devices, assigning one of said

15   frequencies to each head per zone, based on a capability of that head.

2.   (Currently Amended) The method of claim 1, wherein in step (a)(1)

measuring a performance of each head further includes the step ~~steps~~ of measuring a

record/playback performance of that head at one or more read/write frequencies.

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3.   (Currently Amended) The method of claim 1, wherein in step (a)(1) measuring a performance of each head further includes the step ~~steps~~ of measuring a record/playback performance of that head at multiple storage media ~~medium~~ locations.

4.   (Currently Amended) The method of claim 1, wherein in step (a)(1) measuring a performance of each head further includes the step ~~steps~~ of measuring a record/playback performance of that head according to a performance metric at different frequencies.

5.   (Currently Amended) The method of claim 4, wherein said performance metric includes at least one of on-track symbol error rate ~~on track~~, off-track symbol error rate ~~off track~~, on-track mean square ~~squared~~ error ~~on track~~, and off-track mean square ~~squared~~ error ~~off track~~.

6.   (Currently Amended) The method of claim 1, wherein step (a) is performed in a storage format design process and step (b) is performed in a test process.

7.   (Currently Amended) The method of claim 6, wherein the storage format design process is part of a data storage device design phase and the test process is part of a data storage device manufacturing phase.

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8.   (Currently Amended) The method of claim 1, wherein step (a)(1) further includes the step ~~steps~~ of calibrating each of said multiple data storage devices for each of said frequencies.

9.   (Currently Amended) The method of claim 1, wherein step (a)(2) further includes the step ~~steps~~ of jointly selecting said frequencies and allocating said heads to said frequencies, to satisfy a specified constraint.

10.   (Currently Amended) The method of claim 9, wherein:

step (a)(1) further includes the steps of, for each of said sample number of said data storage devices:

selecting a performance metric for the heads in that data storage device for each zone; and

measuring a performance of each head at different frequencies per zone based on said metric; and

step (a)(2) further includes the step ~~steps~~ of, for the multiple data storage devices:

based on said performance measurements, for each zone allocating an integral number of said heads to each of said frequencies for that zone to satisfy the specified constraint.

11.   (Currently Amended) The method of claim 10, wherein in step (a)(2) allocating said heads to said frequencies per zone further includes the step of, ~~steps of:~~

for each zone, based on the performance of the heads in a plurality of zones, allocating an

integral number of <u>said</u> heads to each of said frequencies for that zone to satisfy said

5   constraint for said multiple data storage devices.

     12.   (Currently Amended) The method of claim 10, wherein step (a)(2) further

includes the steps of:

     based on said performance measurements, generating record/playback

frequency capability distributions of the heads in the sample number of <u>said data storage</u>

5   <u>devices,</u> ~~disk drives,~~ at each zone for a target performance metric, and

     based on said distributions, allocating an integral number of <u>said</u> heads to

each of said frequencies for that zone to satisfy said constraint for said multiple data

storage devices.

     13.   (Original) The method of claim 9, wherein said constraint comprises

providing a required data storage capacity for each of said multiple data storage devices.

     14.   (Previously Presented) The method of claim 9, wherein said constraint

comprises providing a required data storage device yield for said multiple data storage

devices.

     15.   (Currently Amended) The method of claim 9, wherein said constraint

comprises maximizing <u>a</u> ~~the~~ data storage device yield <u>for the multiple data storage</u>

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devices while providing a specified data storage device capacity for ~~of~~ the multiple data storage devices.

16. (Currently Amended) The method of claim 9, wherein said constraint comprises maximizing a ~~the~~ data storage capacity for each of the multiple data storage devices while providing a specified data storage device yield for the multiple data storage devices.

17. (Currently Amended) A method of defining a storage format in multiple data storage devices, each data storage device having a plurality of storage media and a plurality of corresponding data transducer heads, each ~~transducer~~ head for recording on and playback of information from a corresponding storage media ~~medium~~ in multiple

5   zones, the method comprising the steps of:

(a)   (1) for a sample number of said data storage devices, measuring a performance of each head in the sample number of said data storage devices at one or more read/write frequencies per zone, and based on said performance measurements, generating performance distributions of the heads in said sample number of said data

10   storage devices, at each zone for a target performance metric, and

(2) for said multiple data storage devices, based on said performance distributions, jointly ~~jointly:~~ selecting a group of read/write frequencies, two or more read/write frequencies for each zone, and allocating one or more of the heads in each of the multiple data storage devices to each frequency in said group of frequencies per zone;

15   and

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(b)   in each of said multiple data storage devices, assigning one of said

frequencies to each head per zone, based on a capability of that head.

18.   (Currently Amended) The method of claim 17, wherein generating said

distributions further includes the steps of:

estimating a record/playback frequency capability of each head based on

said performance measurements; measurements, and

5   generating record/playback frequency capability distributions of the heads

at each zone for said a target performance metric based on said estimated record/playback

frequency capabilities of the heads.

19.   (Currently Amended) The method of claim 17, wherein the step steps of

generating said distributions is performed in a post-processing phase.

20.   (Currently Amended) The method of claim 17, wherein generating said

distributions includes the step of steps of: generating record/playback frequency

capability distributions of the heads based on said performance measurements at said a

target performance metric for the heads in said sample number of said data storage

devices.

21.   (Currently Amended) The method of claim 17, wherein in step (a)(2)

selecting said group of frequencies further includes the step steps of selecting said group

of frequencies to satisfy a specified constraint.

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22.   (Currently Amended) The method of claim 17, wherein said performance metric includes at least one of on-track symbol error rate ~~on track~~, off-track symbol error rate ~~off track~~, on-track mean square ~~squared~~ error ~~on track~~, and off-track mean square ~~squared~~ error ~~off track~~.

23.   (Currently Amended) A method of defining a storage format in multiple data storage devices, each data storage device having a plurality of storage media and a plurality of corresponding data transducer heads, each ~~transducer~~ head for recording on and playback of information from a corresponding storage media ~~medium~~ in multiple

5   zones, the method comprising the steps of:

(a)   (1)   for a sample number of said data storage devices, measuring a performance of each head in the sample number of said data storage devices at one or more read/write frequencies per zone, and

(2)   for said multiple data storage devices, based on said performance

10   measurements, jointly ~~jointly:~~ selecting a group of read/write frequencies, two or more read/write frequencies for each zone, and for each zone allocating an integral number of said heads to each of said frequencies for that zone to satisfy a constraint; and

(b)   in each of said multiple data storage devices, assigning one of said frequencies to each head per zone, based on a capability of that head and said allocation

15   of the heads.

24.   (Currently Amended) The method of claim 23, wherein step (b) further includes the steps of, for each of said multiple data storage devices:

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(i)   obtaining a record/playback performance of each head at a performance metric per zone at one of said read/write frequencies;

(ii)   for each zone, ranking the heads from best to worst according to the performance metric; and

(iii)   assigning said allocated number of heads, according to the ranking, to one of said read/write frequencies.

25.   (Currently Amended) The method of claim 24, further comprising the <u>step</u> ~~steps~~ of:

repeating steps (i)-(iii) for the remaining heads at the other read/write frequencies.

26.   (Original) The method of claim 24, wherein steps (i)-(iii) are repeated for each of said frequencies, starting from the highest frequency to the lowest frequency.

27.   (Currently Amended) The method of claim 24, <u>wherein</u> ~~wherein:~~ step (ii) further includes the <u>step</u> ~~steps~~ of selecting said performance metric for the heads in that data storage device for each zone.

28.   (Currently Amended) The method of claim 23, wherein for each head in said multiple data storage devices, <u>the same</u> ~~said~~ number of <u>said</u> zones are on different storage media in each data storage device.

29. (Currently Amended) The method of claim 23, wherein for each head in said multiple data storage devices, the same ~~said~~ number of said zones are on the same storage media in each data storage device.

30. (Currently Amended) The method of claim 23, wherein in step (a)(2) said constraint ~~specified criteria~~ comprises providing a specified data storage capacity for each of the multiple data storage devices while maximizing a data storage device yield for the multiple data storage devices.

31. (Currently Amended) The method of claim 23, wherein in step (a)(2) said constraint ~~specified criteria~~ comprises maximizing a ~~the~~ data storage capacity for each of the multiple data storage devices while providing a specified data storage device yield for the multiple data storage devices.

32. (Currently Amended) The method of claim 23, wherein step (b) further includes the step ~~steps~~ of calibrating each data storage device for each frequency.

33. (Currently Amended) A method of defining a storage format in multiple data storage devices, each data storage device having a plurality of storage media and a plurality of corresponding data transducer heads, each ~~transducer~~ head for recording on and playback of information from a corresponding storage media ~~medium~~ in multiple zones, the method comprising the steps of:

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(a)   (1) for a sample number of said data storage devices, measuring a performance of each head in the sample number of said data storage devices at one or more read/write frequencies per zone, and

    (2) for said multiple data storage devices, based on said

10   performance measurements, jointly ~~jointly:~~ selecting a group of read/write frequencies, two or more read/write frequencies for each zone, and allocating one or more of the heads in each of the multiple data storage devices to each frequency in said group of frequencies per zone; and

(b)   in each of said multiple data storage devices, assigning one of said

15   frequencies to each head per zone, based on a capability of that head;

wherein in each of said multiple data storage devices:

said multiple zones on each storage media are arranged as concentric zones, each zone having an inner and an outer boundary at different radial locations on the storage media,

20   such that each storage media includes the same number of concentric zones as other storage media in that data storage device, and ~~such that~~ the boundaries of radially similarly situated zones on all the storage media in that data storage device are at the same radial locations.

34.   (Original) The method of claim 33, wherein radially similarly situated zones on all the storage media include the same number of concentric tracks.

35.   (Currently Amended) The method of claim 33, wherein at least a number of radially similarly situated zones on all the storage media include a different number of concentric tracks.

36.   (Currently Amended) A method of defining a storage format in multiple data storage devices, each data storage device having a plurality of storage media and a plurality of corresponding data transducer heads, each ~~transducer~~ head for recording on and playback of information from a corresponding storage media ~~medium~~ in multiple

5   zones, the method comprising the steps of:

(a)   (1) for a sample number of said data storage devices, measuring a performance of each head in the sample number of said data storage devices at one or more read/write frequencies per zone, and

(2) for said multiple data storage devices, based on said

10   performance measurements, jointly ~~jointly:~~ selecting a group of read/write frequencies, two or more read/write frequencies for each zone, and allocating one or more of the heads in each of the multiple data storage devices to each frequency in said group of frequencies per zone; and

(b)   in each of said multiple data storage devices, assigning one of said

15   frequencies to each head per zone, based on a capability of that head;

wherein in each of said multiple data storage devices:

said multiple zones on each storage media are arranged as concentric zones, each zone having an inner and an outer boundary at different radial locations on the storage media,

20   such that each storage media includes a sequence of concentric zones, <u>and</u>

~~such that~~ the boundaries of at least a number of sequentially similarly situated zones on

different storage media in that data storage device are at different radial locations.

37.   (Original) The method of claim 36, wherein sequentially similarly situated

zones on all the storage media include the same number of concentric tracks.

38.   (Currently Amended) The method of claim 36, wherein at least a number

of sequentially similarly situated zones on all the storage media include <u>a</u> different

number of concentric tracks.

39.   (Currently Amended) A data storage device comprising a plurality of pairs

of storage media surfaces and transducer heads, each ~~transducer~~ head for recording on

and playback of information from a corresponding storage <u>media surface</u> ~~medium~~ in

multiple zones, and a controller that controls the heads for reading and writing data on the

5   <u>storage</u> media surfaces, the controller being programmed to write data in a storage format

defined by the steps including:

(a)   (1) for a sample number of <u>multiple</u> data storage devices, measuring a

performance of each head in the sample number of <u>said</u> data storage devices at one or

more read/write frequencies per zone, and

10   (2) for said data storage device, based on said performance

measurements, <u>jointly</u> ~~jointly:~~ selecting a group of read/write frequencies, two or more

read/write frequencies for each zone, and allocating one or more of the heads in said ~~that~~

data storage device to each frequency in said group of frequencies per zone; and

(b)   in said data storage device, assigning one of said frequencies to each head

15   per zone, based on a capability of that head, thereby defining said storage format.

40.   (Currently Amended) The data storage device of claim 39, wherein in step

(a)(1) measuring a performance of each head further includes the step ~~steps~~ of measuring

a record/playback performance of that head according to a performance metric at

different frequencies.

41.   (Currently Amended) The data storage device of claim 39, wherein step

(a) is performed in a data storage device design phase and step (b) is performed in a data

storage device manufacturing phase.

42.   (Currently Amended) The data storage device of claim 39, wherein step

(a)(1) further includes the step ~~steps~~ of calibrating each of said multiple data storage

devices for each of said frequencies.

43.   (Currently Amended) The data storage device of claim 39, wherein step

(a)(2) further includes the step ~~steps~~ of jointly selecting said frequencies and allocating

said heads to said frequencies, to satisfy a specified constraint.

44.   (Currently Amended) The data storage device of claim 43, wherein:

step (a)(1) further includes the steps of, for each of said sample number of said data storage devices:

selecting a performance metric for the heads in that data storage device for each zone; and

measuring a performance of each head at different frequencies per zone based on said metric; and

step (a)(2) further includes the step steps of, for the multiple data storage devices:

based on said performance measurements, for each zone allocating an integral number of said heads to each of said frequencies for that zone to satisfy the specified constraint.

45.   (Currently Amended) The data storage device of claim 44, wherein in step (a)(2) allocating said heads to said frequencies per zone further includes the step of, steps of: for each zone, based on the performance of the heads in a plurality of zones, allocating an integral number of said heads to each of said frequencies for that zone to satisfy said constraint for said multiple data storage devices.

46.   (Currently Amended) The data storage device of claim 44, wherein step (a)(2) further includes the steps of:

based on said performance measurements, generating record/playback frequency capability distributions of the heads in the sample number of <u>said data storage devices,</u> <s>disk drives,</s> at each zone for a target performance <u>metric;</u> <s>metric,</s> and

based on said distributions, allocating an integral number of <u>said</u> heads to each of said frequencies for that zone to satisfy said constraint for said multiple data storage devices.

47. (Original) The data storage device of claim <u>43,</u> <s>44,</s> wherein said constraint comprises providing a required data storage capacity for each of said multiple data storage devices.

48. (Previously Presented) The data storage device of claim 43, wherein said constraint comprises providing a required data storage device yield for said multiple data storage devices.

49. (Currently Amended) The data storage device of claim 43, wherein said constraint comprises maximizing <u>a</u> <s>the</s> data storage device yield <u>for the multiple data storage devices</u> while providing a specified data storage device capacity <u>for</u> <s>of</s> the multiple data storage devices.

50. (Currently Amended) The data storage device of claim 43, wherein said constraint comprises maximizing <u>a</u> <s>the</s> data storage capacity for each of the multiple data

storage devices while providing a specified data storage device yield <u>for the multiple data storage devices</u>.

51.   (Currently Amended) A data storage device comprising a plurality of pairs of storage media surfaces and transducer heads, each ~~transducer~~ head for recording on and playback of information from a corresponding storage <u>media surface</u> ~~medium~~ in multiple zones, and a controller that controls the heads for reading and writing data on the

5   <u>storage</u> media surfaces, the controller being programmed to write data in a storage format defined by the steps including:

(a)   (1) for a sample number of <u>multiple</u> data storage devices, measuring a performance of each head in the sample number of <u>said</u> data storage devices at one or more read/write frequencies per zone, and based on said performance measurements,

10   generating performance distributions of the heads in said sample number of <u>said</u> data storage devices, at each zone for a target performance metric, and

(2) for the data storage device, based on said performance distributions, <u>jointly</u> ~~jointly:~~ selecting a group of read/write frequencies, two or more read/write frequencies for each zone, and allocating one or more of the heads in each of the multiple

15   data storage devices to each frequency in said group of frequencies per zone; and

(b)   in the data storage <u>device,</u> ~~devices,~~ assigning one of said frequencies to each head per zone, based on <u>a</u> capability of that head.

52.   (Currently Amended) The data storage device of claim 51, wherein generating said distributions further includes the steps of:

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estimating a record/playback frequency capability of each head based on said performance measurements; ~~measurements,~~ and

5   generating record/playback frequency capability distributions of the heads at each zone for said ~~a~~ target performance metric based on said estimated record/playback frequency capabilities of the heads.

53.   (Currently Amended) The data storage device of claim 51 wherein the step ~~steps~~ of generating said distributions is performed in a post-processing phase.

54.   (Currently Amended) The data storage device of claim 51, wherein generating said distributions includes the step of ~~steps of:~~ generating record/playback frequency capability distributions of the heads based on said performance measurements at said ~~a~~ target performance metric for the heads in said sample number of said data storage devices.

55.   (Currently Amended) The data storage device of claim 51, wherein in step (a)(2) selecting said group of frequencies further includes the step ~~steps~~ of selecting said group of frequencies to satisfy a specified constraint.

56.   (Currently Amended) A data storage device comprising a plurality of pairs of storage media surfaces and transducer heads, each ~~transducer~~ head for recording on and playback of information from a corresponding storage media surface ~~medium~~ in multiple zones, and a controller that controls the heads for reading and writing data on the

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5 storage media surfaces, the controller being programmed to write data in a storage format

defined by the steps including:

(a)   (1) for a sample number of multiple data storage devices, measuring a

performance of each head in the sample number of said data storage devices at one or

more read/write frequencies per zone, and

10   (2) for said data storage device, based on said performance

measurements, jointly jointly: selecting a group of read/write frequencies, two or more

read/write frequencies for each zone, and for each zone allocating an integral number of

said heads to each of said frequencies for that zone to satisfy a constraint; and

(b)   in said data storage device, assigning one of said frequencies to each head

15 per zone, based on a capability of that head and said allocation of the heads.

57.   (Currently Amended) The data storage device of claim 56, wherein step

(b) further includes the steps of, for the data storage device:

(i)   obtaining a record/playback performance of each head at a

performance metric per zone at one of said read/write frequencies;

5   (ii)   for each zone, ranking the heads from best to worst according to

the performance metric; and

(iii)   assigning said allocated number of heads, according to the ranking,

to one of said read/write frequencies.

58.   (Currently Amended) The data storage device of claim 57, wherein step

(b) further comprises the step steps of:

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repeating steps (i)-(iii) for the remaining heads at the other read/write frequencies.

59.   (Currently Amended) The data storage device of claim 57, wherein step (b) further includes the step ~~steps~~ of selecting said performance metric for the heads in the ~~that~~ data storage device for each zone.

60.   (Currently Amended) The data storage device of claim 56, wherein in step (a)(2) said constraint ~~specified criteria~~ comprises providing a specified data storage capacity for the multiple data storage devices while maximizing a data storage device yield for the multiple data storage devices.

61.   (Currently Amended) The data storage device of claim 56, wherein in step (a)(2) said constraint ~~specified criteria~~ comprises maximizing a ~~the~~ data storage capacity for each of the multiple data storage devices while providing a specified data storage device yield for the multiple data storage devices.

62-64. (Cancelled)

65.   (Currently Amended) A data storage device comprising a plurality of pairs of storage media surfaces and transducer heads, each ~~transducer~~ head for recording on and playback of information from a corresponding storage media surface ~~medium~~ in multiple zones, and a controller that controls the heads for reading and writing data on the

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5   storage media surfaces, the controller being programmed to write data in said multiple

zones, wherein:

said multiple zones on each storage media are arranged as concentric

zones, each zone having an inner and an outer boundary at different radial locations on

the storage media,

10   such that each storage media includes a sequence of concentric zones, and

~~such that~~ the boundaries of at least a number of sequentially similarly situated zones on

different storage media in the ~~that~~ data storage device are at different radial locations,

wherein sequentially similarly situated zones on all the storage media include the same

number of concentric tracks.

66-67. (Cancelled)